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United States Department of Agriculture,

OFFICE OF EXPERIMENT STATIONS,

A. C. TRUE, Director.

FIFTH REPORT OF COMMITTEE ON METHODS OF TEACHING AGRICULTURE.[1]

The committee on methods of teaching agriculture submits a fifth report of progress. During the past year the committee has studied the three general subdivisions of the subject of agriculture not outlined in its previous reports and has formulated a syllabus for each of these subjects, which is given in the present report. This completes the general survey of the college course in agriculture, according to the programme laid down by the committee in its second report, in which the subject of agriculture was divided into five subdivisions—agronomy, zootechny, agrotechny, rural engineering, and rural economics. It will now be the aim of the committee to secure further study and discussion of this course and to gather the results of its application to the actual requirements of agricultural colleges, with a view to making such modifications in this programme as experience may demonstrate to be desirable. It is also hoped that the completion of this general survey of a course in agriculture will open the way for the committee to devote itself hereafter to the more detailed study of special features of instruction in agriculture, with a view to aiding still further the movement now in active progress in this country for strengthening and developing courses in agriculture to meet the needs of various classes of students.

SYLLABUS OF COURSE IN AGROTECHNY.

In its broadest sense agrotechny would include a wide range of subjects, such as the making of butter, cheese, sugar, starch, vegetable and animal oils, vinegar, concentrated foods and feeding stuffs, canned goods, malt and alcoholic liquors, textiles, and leather. For the purposes of a general college course in agriculture in the United States it will ordinarily include only dairying, with brief treatment of other industries locally important, e. g., sugar in Louisiana, Nebraska, and Vermont; olive oil in California; cotton goods in South Carolina, Georgia, and Mississippi; flour in Minnesota; meat products in Illinois; and corn products in Kansas. In the following outline, therefore, provision is made for such brief introductory consideration of the subject as a whole, and more detailed treatment of dairying, as may be reasonably given in the time (72 hours) assigned to agrotechny in the general course in agriculture. It is not intended in this syllabus to cover the requirements of special schools and courses in dairying, sugar making, etc. This matter requires special attention and may be taken up by the committee at some future time.

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[1] Committee of the Association of American Agricultural Colleges and Experiment Stations, whose fifth report was presented to the convention of the Association held at New Haven and Middletown, Conn., November 13–15, 1900. For previous reports see U. S. Dept. Agr., Office of Experiment Stations Buls. 41, p. 57; 49, p. 29; 65, p. 79, and 76, p. 39; and Circs. 32, 37, 39, and 41.

GENERAL OUTLINE OF TOPICS IN AGROTECHNY.

- **Definition**
  - Agrotechny is the theory and practice of the conversion of raw materials produced by agriculture into manufactured articles for use in commerce and the arts.
- **The raw material**
  - Source.
  - Standard
    - Properties.
    - Departures from standard.
      - Natural.
      - Artificial.
    - Determination.
  - Handling.
  - Uses.
- **Manufacture**
  - Processes.
  - Equipment.
- **The product**
  - Description.
  - Standard
    - Properties.
    - Departures from standard.
    - Determination.
  - Handling.
  - Marketing.
  - Uses.

DAIRYING.

- **The raw material—Milk.**
  - Source
    - Kind of animal.
    - Physiology of secretion.
    - Milking
      - Frequency.
      - Regularity.
      - Method
        - By hand.
        - By machine.

DAIRYING—Continued.

- **The raw material—Milk—Continued.**
  - Standard
    - Properties
      - Physical.
      - Chemical.
      - Biological.
    - Departures from standard
      - Natural
        - Due to animal
          - Lactation.
          - Food.
          - Environment.
        - Due to microorganisms.
      - Artificial
        - Impurities.
        - Adulteration.
    - Determination
      - For specific gravity.
      - For fat.
      - For organisms.
      - For impurities.
      - For adulteration.
  - Handling
    - Cleanliness
      - Stables.
      - Cows.
      - Attendants.
      - Vessels.
    - Control of fermentation
      - Prevention of infection.
      - Refrigeration.
      - Aeration.
      - Pasteurization.
      - Sterilization.
  - Uses[1]
    - For consumption as milk or cream.
    - For condensed milk or cream.
    - For butter.
    - For cheese.
    - For artificial beverages.
    - For sugar.
    - For casein preparations.
- **Milk and cream for consumption.**
  - Preparation for sale
    - Removal of sediment
      - Straining.
      - Centrifugal.
      - Separation.
    - Standardizing.
    - Creaming as affected by
      - Pasteurization.
      - Centrifugal.
      - Separation.
    - Packages
      - Cans.
      - Bottles.
    - Bottling
      - Washing.
      - Sterilizing.
      - Filling.
      - Capping.
  - Delivery and sale
    - Wagons.
    - Tickets.
    - Accounts.

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[1] In this syllabus only the following uses of milk will be considered in detail: (1) For consumption, (2) for butter, and (3) for cheese.

DAIRYING—Continued.

- **Butter making** (manufacture).
  - Processes.
    - Theory.
    - Creaming.
      - Gravity.
        - Shallow pans.
        - Deep cans.
          - Shot-gun cans.
          - "Cooley" system.
          - Dilution separators.
      - Centrifugal (separator).
        - History.
        - Theory.
        - Styles and types.
        - Operation.
          - Setting.
          - Speeding.
          - Inflow.
          - Regulation of cream.
    - Ripening.
      - Purpose.
      - Temperature.
        - Cooling after separating.
        - Reheating.
      - Starters.
        - Natural.
          - Sour cream.
          - Sour milk.
          - Buttermilk.
        - Artificial.
          - Preparation.
          - Propagation.
          - Use.
      - Determination of of ripeness.
        - Appearance.
        - Consistency.
        - Acidity.
          - Taste.
          - Acid tests.
    - Churning.
      - Theory.
      - Temperature.
      - Breaking.
      - Difficult churning.
      - Churns.
        - Form.
        - Size.
        - Speed.
    - Finishing.
      - Removal of buttermilk.
      - Addition of salt.
        - Brine.
        - Dry.
      - Working.
        - Purpose.
        - Amount necessary.
        - Temperature.
    - Packing.
      - Prints.
        - Apparatus.
        - Covers.
      - Tubs.
        - Sizes.
        - Materials.
      - Stone jars.
      - Paper packages.
  - Equipment.
    - Farm dairy.
    - Creamery.
      - Location.
      - Construction.
      - Arrangement.
      - Equipment.
      - Management.

DAIRYING—Continued.

- **Butter** (The product.)
  - Description.
  - Standard
    - Properties
      - Physical
        - Texture.
        - Color.
        - Finish.
      - Chemical.
      - Biological
        - Flavor.
    - Departures from standard.
    - Determination.
  - Handling.
  - Marketing.
  - Uses.
- **Cheese making.** (Manufacture)
  - Processes
    - Theory.
    - Kinds of cheese
      - Cheddar.
      - Swiss.
      - Brick,
      - Limburger.
      - Foreign varieties (Roquefort, etc.).
    - Preparation of milk.
    - Separation and manipulation of curd
      - Rennet
        - Source.
        - Preparation.
        - Action.
      - Setting.
      - Cutting.
      - Heating.
      - Cheddaring.
      - Grinding.
    - Salting.
    - Pressing.
    - Curing.
    - Packing.
  - Equipment
    - Factory.
    - Farm dairy.
      - Location.
      - Construction.
      - Arrangement.
      - Apparatus.
      - Management.
- **Cheese** (The product.)
  - Description.
  - Standard
    - Properties
      - Physical
        - Texture.
        - Color.
        - Finish.
      - Chemical.
      - Biological
        - Flavor.
    - Departures from standard.
    - Determination.
  - Handling.
  - Marketing.
  - Uses.

SYLLABUS OF COURSE IN RURAL ENGINEERING.

In its most comprehensive sense rural engineering includes all the branches of civil and mechanical engineering relating to the locating, arranging, and equipping of farms, and the construction and operation of farm implements and machinery. A prerequisite to thorough knowledge of rural engineering would thus be a general course in civil and mechanical engineering. As students in an agricultural course in our colleges can not be expected to have this preliminary training (except some knowledge of surveying and the use of surveying instruments, which is quite essential), it will be necessary to confine the course in rural engineering as a part of the general course in agriculture to the more elementary matters which will be understood by such students, and which have a direct, practical bearing on farm management.

There is need of the establishment of thorough courses in rural engineering as specialties in some of our higher institutions, in order that well-trained rural engineers may be produced to act as leaders in the advancement of engineering enterprises for the benefit of agriculture.

- **Definition**
  - Rural engineering is the science and art of laying out farms, designing and constructing farm buildings and works, and making and using farm implements and machinery.
- **Laying out the farm.**
  - Principles of selection.
  - Survey.
  - Location of buildings and works (drains, irrigation ditches, wells, and roads).
  - Division into fields and yards.
  - Map of farm.
- **Construction of buildings and works**
  - Buildings
    - Principles of construction.
    - Materials.
    - Classification[1]
      - House.
      - Barn.
      - Piggery.
      - Poultry house.
      - Tool house.
      - Creamery.
      - Fences.
    - Purpose.
    - Plans.
    - Methods of building.
    - Cost.
  - Water system
    - Springs.
    - Wells.
    - Reservoirs.
    - Pumps and other water lifts.
    - Conduits.
    - Tanks.
    - Plumbing.

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[1] The list given is only illustrative. The buildings to be discussed in this course would vary with the region, system of farming, etc.

SYLLABUS OF COURSE IN RURAL ENGINEERING—Continued.

- **Construction, etc.—Continued.**
  - Irrigation system
    - Theory.
    - Water supply (sources, character, and means of obtaining).
    - Works
      - Reservoirs.
      - Canals.
      - Laterals and ditches.
      - Appliances for measurement and division of water.
    - Methods of application.
  - Drains
    - Removal of surface water (drainage of swamps, etc.).
    - Soil drainage
      - Theory.
      - Open drains.
      - Covered drains (including stone, brush, tile, etc.).
  - Sewage system.
  - Roads
    - Location.
    - Materials.
    - Construction.
    - Maintenance.
- **Construction and use of farm machinery.**
  - Principles of mechanics as applied to farm machinery.
  - Classification
    - Power machines
      - Steam.
      - Gasoline.
      - Water.
      - Wind.
      - Horse.
      - Man.
    - Plows.
    - Surface-working machines.
    - Seeding machines.
    - Harvesting machines.
    - Food-preparing machines.
    - Farm vehicles.
    - Small implements.
  - Structure.
  - Operation
    - Principles.
    - Practice.
  - Repairing.

SYLLABUS OF COURSE IN RURAL ECONOMICS.

- **Definition**
  - Rural economics treats of agriculture as a means for the production, preservation, and distribution of wealth by the use of land for the growing of plants and animals. It may include the development of agriculture as a business (history of agriculture), as well as the facts and principles of farm management under present conditions.
- **History of agriculture**
  - Development of different forms.
    - Grazing.
    - Plant husbandry.
    - Mixed husbandry.
    - Special farming.
  - Agriculture in different periods (with special reference to land tenure, equipment, labor system, prominent products, social and financial condition of farmers).
    - I. Prior to 500 B. C. (Egyptian.)
    - II. 500 B. C. to 500 A. D. (Grecian and Roman.)
    - III. 500 A. D. to 1500 A. D. (Western Europe—feudal system.)
    - IV. 1500 A. D. to 1800 A. D. (Especially in Great Britain.)
    - V. 1800 A. D. to 1900 A. D. (Especially in United States.)

SYLLABUS OF COURSE IN RURAL ECONOMICS—Continued.

- **Farm management.**
  - Capital
    - Land
      - Value as determined by location, suitability, etc.
      - Purchase, rental, and sale.
      - Cost of maintenance
        - Taxes.
        - Rents.
        - Interest.
      - Legal requirements.
    - Equipment
      - Nature (as related to particular kinds of farming).
        - Buildings.
        - Fences, roads, wells, drains.
        - Implements.
        - Live stock.
      - Value.
      - Cost of maintenance
        - Taxes.
        - Insurance.
        - Repairs.
        - Feeding.
      - Legal requirements.
  - Labor
    - Systems (wage, share, tenant).
    - Contracts, including methods of payment.
    - Cost, as affected by labor supply, use of machinery, nature of work, etc.
    - Management.
  - Production
    - Methods and cost (with reference to different systems of farming).
  - Marketing
    - Preparation for market.
    - Choice of market.
    - Transportation.
    - Method and cost of sale.
    - Legal requirements, e. g., weights, measures, packages, commissions, inspection.
  - Records and accounts
    - Crop records.
    - Feed and milk records.
    - Breeding records.
    - Inventories.
    - Bookkeeping.

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